

Application No. 10/717,006  
Attorney Docket No 2003B112  
Amdt. dated April 24, 2006  
Reply to Office Action of January 30, 2006

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### **REMARKS/ARGUMENTS**

Reconsideration of this application is requested. The claims submitted for reconsideration are claims 1, 6-14, 17-22, and 27-33.

Independent claims 1 and 18 have been amended by incorporating preferred elements relating to methanol to ethanol weight ratios, type of molecular sieve catalyst and temperature of operation. The preferred methanol to ethanol weight ratio comes from now canceled claim 2. The preferred catalyst, silicoaluminophosphate molecular sieve, is discussed in paragraph [0147] of the specification, page 42. The preferred minimum temperature of operation is described in Examples II and III, and in Tables III and IV in detail. The resulting ratio of ethylene to propylene in the product, which is also stated in the claim, is also described in Examples II and III, including Tables III and IV.

#### **Claim Rejections – 35 USC § 102(b)**

Claims 1-6 were rejected under 35 USC § 102(b) as being anticipated by Fung *et al.*, U.S. Patent No. 6,441,262 (hereinafter "Fung"). This rejection is traversed and reconsideration is requested.

This invention is directed to converting an alcohol-containing stream to light olefins. The alcohol-containing stream contains methanol and ethanol at a weight ratio of methanol to ethanol of from about 5.33 to about 9.33. The alcohol-containing composition is contacted with silicoaluminophosphate molecular sieve catalyst at a temperature of at least 475°C, which produces an olefin composition containing ethylene and propylene at a weight ratio of at least 1.25.

Fung discloses using silicoaluminophosphate molecular sieve catalyst to convert a combination of methanol and ethanol to light olefins. The Fung reference is particularly concerned with the problem of how to moderate the olefin product content in an alcohol conversion reaction in which the alcohol feed is predominantly methanol. Fung addresses this problem by using two contact zones. One zone is referred to as an oxygenate conversion zone, which is where a combination of unregenerated and regenerated catalyst contacts methanol for conversion to olefin. The other zone is referred to as an alcohol contact zone, which is where

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ethanol, propanol, or butanol is contacted with regenerated and fresh catalyst. The use of this dual contacting zone allows for manipulating the olefin content in the product stream.

This invention is concerned with a more particular problem than that addressed by Fung. More specifically, this invention is concerned with maximizing the amount of light or prime olefin formed (i.e., ethylene plus propylene), and at the same time further maximizing the amount of ethylene in the product. This problem is solved by providing a particular mix of methanol and ethanol to a reaction zone, and contacting that mix with a silicoaluminophosphate molecular sieve catalyst in the same reaction zone. The two reaction zone approach used by Fung is not required.

In order to maximize the overall production of ethylene and propylene, while further maximizing the amount of ethylene produced, Applicants have found that contacting a feed having a weight ratio of methanol to ethanol of from about 5.33 to about 9.33 with a silicoaluminophosphate molecular sieve catalyst at relatively high temperatures (at least 475°C) produces a highly desirable product rich in ethylene and propylene, and containing more ethylene than propylene. Applicants' Examples II and III (especially Tables III and IV) show that under the preferred process conditions, the overall production of ethylene and propylene is increased. At the same time, the amount of ethylene in the product is particularly high (an ethylene to propylene weight ratio of at least 1.25).

The ability of forming an olefin product that has a high ethylene and propylene content, with a predominant amount of ethylene, can be achieved by the Fung process. However, Fung does so by using a combination of two different reaction zones and two different feeds. This invention simplifies the Fung process in that only one zone or vessel is needed when applying the process steps as claimed. Such a simplification is not suggested by Fung.

#### Claim Rejections – 35 USC § 103(a)

Claims 7, 8, and 15-17 were rejected under 35 USC § 103(a) as being unpatentable over Fung *et al.* in view of U.S. Patent No. 4,994,498 to Kinkade (hereinafter "Kinkade"). Claims 15 and 16 have been canceled by this amendment. Therefore, the rejection of those claims is rendered moot. The rejection, as it pertains to the remaining claims, is traversed and reconsideration is requested.

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Kinkade is directed to a catalyst that is useful for converting carbon monoxide and hydrogen to a mixture of lower alkanols. The catalyst consists essentially of molybdenum sulfide, an alkali metal compound, and a tantalum compound.

Coupling Kinkade with Fung addresses only the formation of certain types of alcohols. Combining the teachings of the two references does not, however, provide any way of simplifying the overall Fung process so as to provide a simple way to produce a high quantity of ethylene and propylene, and with more ethylene than propylene. Accordingly, the combination of Fung with Kinkade does not suggest the claimed invention.

Claims 9-14 were rejected under 35 USC § 103(a) as being unpatentable over Fung *et al.* in view of Kinkade as applied to claims 7, 8, and 15-17, and further in view of Stevens *et al.*, U.S. Patent No. 4,752,623 (hereinafter "Stevens") and Fukui *et al.*, U.S. Patent No. 6,114,279 (hereinafter "Fukui"). This rejection is traversed and reconsideration is requested.

Stevens discloses producing mixed alcohols from carbon monoxide and hydrogen gases using a catalyst/co-catalyst metal catalyst. The catalyst metals are molybdenum, tungsten or rhenium. The co-catalyst metals are cobalt, nickel, or iron. The catalyst is promoted with a Fischer-Tropsch promoter like an alkali or alkaline earth series metal or a smaller amount of thorium and is further treated by sulfiding. The composition of the mixed alcohols fraction can be selected by selecting the extent of intimate contact among the catalytic components.

Combining Stevens with Fung and Kinkade still fails to provide any way to simplify the overall Fung process in the manner previously noted. Accordingly, the combination of Fung with Kinkade and Stevens does not suggest the claimed invention.

Fukui discloses a catalyst for methanol synthesis and reforming which is constituted of copper, zinc, and aluminum oxides and has a structure comprising copper or copper oxide particles covered with a film of aluminum oxide and zinc oxide. The copper or copper oxide particles preferably have a particle size of 1 to 100 nm. The film of aluminum oxide and zinc oxide preferably has a thickness of 0.1 to 100 nm. The proportions of the copper, zinc, and aluminum elements are 68.0 to 86.0% by weight, 4.5 to 21.0% by weight, and 2.0 to 20.0% by weight, respectively. The catalyst can be obtained by a standard co-precipitation method, without using any additive element.

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Combining Fukui with Stevens, Fung and Kinkade also fails to provide any way to simplify the overall Fung process. The combination does not overcome the deficiency of Fung alone. That is, the combination does not suggest using a particular mix of methanol and ethanol feed, and contacting that feed with a silicoaluminophosphate molecular sieve catalyst at a temperature of at least 475°C to produce ethylene and propylene at an ethylene to propylene weight ratio of at least 1.25. Accordingly, the combination of Fung with Kinkade, Stevens and Fukui does not suggest the claimed invention.

Claims 18-65 were rejected under 35 USC § 103(a) as being unpatentable over Fung *et al.* in view of Stevens *et al.* and Fukui *et al.* This rejection is traversed and reconsideration is requested.

As already noted the combination of Fung, Kinkade, Stevens and Fukui does not suggest using a particular mix of methanol and ethanol feed, and contacting that feed with a silicoaluminophosphate molecular sieve catalyst at a temperature of at least 475°C to produce ethylene and propylene at an ethylene to propylene weight ratio of at least 1.25. Accordingly, combining Fung with Stevens and Fukui does not suggest the claimed invention.

Claims 66-74 were rejected under 35 USC § 103(a) as being unpatentable over Fung *et al.* in view of Stevens *et al.* and Fukui *et al.* Those claims having been canceled by this Amendment and Response, this rejection is rendered moot.

#### Double Patenting

Claims 1-74 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-49 and 71-93 of co-pending Application No. 10/716,685. In response, a Terminal Disclaimer is filed with this Amendment and Response. Accordingly, the provisional rejection of claims has been rendered moot.

Claims 1-74 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-40 and 58-81 of co-pending Application No. 10/716,894. In response, a Terminal Disclaimer is filed with this Amendment and Response. Accordingly, the provisional rejection of claims has been rendered moot.

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### CONCLUSION

Having demonstrated that the cited references fail to disclose or suggest the invention as claimed, this application is in condition for allowance. Accordingly, Applicants request early and favorable reconsideration in the form of a Notice of Allowance.


If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated, since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response. Please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1712 (Docket #: 2003B112).

Respectfully submitted,

Date:

April 25, 2006



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